JOINT DISCUSSION AT
THE 2003 IAU GENERAL ASSEMBLY, SYDNEY

Title:
THE SUN AND THE HELIOSPHERE AS AN INTEGRATED SYSTEM

Duration: 1 day

Sponsoring IAU Division:
Division II (Sun and Heliosphere)

Supporting Division(s):
Division XI (Space and high Energy Astrophysics)
Division VI (Interstellar Matter)

Participating Commissions(s):
Commission 10 (Solar Activity)
Commission 49 (Interplanetary Plasma and Heliosphere)
Commission 44 (Space and High Energy Astrophysics)

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Editor(s) of the Proceedings:
(Program summary only. There are no detailed proceedings for JDs)
Chief Editor: G. Poletto
Editor: S. T. Suess

Expected Number of Participants:
100

Main Topics of Preliminary Scientific Program:
(i) 3D structure and the Sun - inner heliosphere
(ii) 3D structure and the outer heliosphere - interstellar medium
Termination shock, heliosheath, bow shock, and their remote sensing.
(iii) Temporal and evolutionary changes
Solar cycle evolution and CMEs across the solar system.
(iv) Composition
The signatures of solar processes and interstellar pickup ions throughout the heliosphere.
(v) Energetic particles and cosmic rays
Energetic particle modulation over the solar cycle and throughout the solar system.
(vi) New missions

Detailed Scientific Rationale:

As knowledge of the Sun and the heliosphere grows, it becomes not only possible but preferable to view the global structure, the interaction with the local interstellar medium, and changes over a solar cycle as the behavior of an integrated system. This simply means considering, for example, the character of the solar magnetic field, plasma physics in the transition region and corona, and structure of the interplanetary medium when interpreting and modeling composition of the solar wind or solar energetic particles. It means, as a further example, modeling both the solar wind and the interstellar medium, along with understanding stellar radiation and absorption, when interpreting data on the "hydrogen wall" and termination shock that lie across the front and flanks of the heliosphere and which are reflected in similar structures around other stars with solar-type winds. A hydrogen wall has also been observed around other stars and is the only way the presence of a wind can presently be demonstrated for solar-type stars.

Some missions which have strongly driven the movement towards the integrated system approach are Ulysses, SOHO, Yohkoh, ACE, Voyagers 1/2, and Pioneers 10/11. SOHO and Ulysses have been combined to develop exquisitely detailed pictures of the relationships between solar and heliospheric measurements. Models of the solar magnetic field, the interplanetary magnetic field, and the global heliosphere are being combined with measurements of galactic cosmic rays / energetic particles throughout space and time in the heliosphere to present new models and new problems for cosmic ray modulation. It is anticipated that in the not-too-distant future energetic neutral atom imaging will allow the global structure of the full heliosphere to be seen in full three dimensions.

Upcoming missions which will continue this trend include Solar Orbiter, Solar Dynamics Observatory, Solar Probe, Interstellar Probe, the Particle Acceleration Solar Orbiter, and STEREO.

The Joint Discussion will have two half-day sessions covering four broad subjects: (i) The global heliosphere and the interstellar medium. (ii) Neutral atom and ion composition in the solar atmosphere and interplanetary medium. (iii) Temporal variations and evolution - from the solar cycle to transients. (iv) Missions and observations.

However, instead of structuring the JD in this way, we propose the following pattern: (i) From the Sun to the interstellar medium. (ii) From the transition region to the corona, and on into the solar wind. (iii) Energetic particles, energetic neutral atoms, and composition.

This is a large topic so we will emphasize presentations involving work that leads to, invokes, or has benefitted from the systems, or global approach, as opposed to studies focusing on, or only related to local physical phenomena. The topic is intended to be joint between solar and stellar (e.g., the hydrogen wall) studies, as well as between the solar system disciplines.

Programme:

(i) From the Sun to the interstellar medium: observations and global models

(ii) From the Transition region to the corona, and on into the solar wind.

(iii) Energetic particles, energetic neutral atoms, and composition

(iv) The New Missions